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ABSTRACT
                Recent research in reading comprehension suggests
that there are substantial differences between individuals in their
patterns of resource allocation to text-based (bottom-up) and
knowledge-based (top-down) reading processes. Less able readers tend
to overrely on processes in one direction, producing deleterious
effects on comprehension. Factors underlying an overreliance on
bottom-up processes include the following: schema unavailability or
difficulty in activation; skill deficiency; student misconceptions
about reading as being primarily a bottom-up process; differences in
general cognitive styles; and idiosyncratic patterns of reading
behavior eliciting a mistaken diagnosis of a given reading cycle.
Educators should employ different remediation strategies for poor
readers with different comprehension styles, and should determine
instruction by the cause of the reading difficulty rather than the
manifestation. (DF)

CENTER FOR THE STUDY OF READING

Technical Report No. 124

ETIOLOGY OF READING COMPREHENSION STYLE

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2

Etiology of Reading Comprehension Style

A body of empirical data has been accumulating recently indicating
radical differences between individuals in reading comprehension style
(cf. Spiro & Tirre, 1979; Spiro, Note 1). The theoretical framework guiding
this research characterizes reading comprehension as involving an inter-
action of text-based (or bottom-up) processes and processes related to
the existing knowledge schemata evoked by the text and its context of
occurrence (top-down processes).[1] Whereas early research on schema-
theoretic processes of understanding carried an implicit assumption that
all skilled language users processed discourse in essentially the same
way, it now appears that this is not the case. Experiments conducted
by Spiro and his colleagues indicate substantial differences between
individuals in their patterns of resource allocation to text-based (bottom-
up) versus knowledge-based (top-down) processes (see Spiro, Note 1, for a
review of this research). For skilled readers (adult and child), there
are tendencies for an individual to employ more processes in a preferred
direction (bottom-up or top-down) when characteristics of the situation
permit processing in one direction to substitute for processing in the
other without affecting ultimate performance. For children who are less
able readers, there are tendencies to over-rely on processes in one
direction, producing deleterious effects on comprehension.

What causes some individuals to develop reading comprehension styles
biased toward the text while others manifest a bias toward indulging

3

their prior knowledge at the expense of attention to the text? At this point, the answer must be a blend of data (where it is available) and informed speculation. To provide a hint of the complexity that may characterize the eventual answer, possible sources of one comprehension style, over-reliance on text-based (or bottom-up) processes will be discussed. It should be noted that the list is not intended to be either exhaustive or composed of mutually exclusive causes.

Factors Underlying Over-Reliance on Bottom-Up Processes
Schema Availability and Activation

The most obvious cause of an over-reliance on the text in comprehension is the absence of relevant knowledge structures to utilize in top-down processing-- if schemata do not exist they cannot be used. However much the vocabulary and syntax of a physics text are simplified, it is unlikely fifth graders will successfully comprehend it without first acquiring the requisite background of scientific knowledge.

It should be noted, however, that schema availability alone is not a sufficient condition for adequate comprehension (see Experiments II-IV in Bransford & Johnson, 1972). Relevant schemata must be activated. The processes by which schemata are evoked are not well understood at this time. However, it appears likely that problems of schema accessibility will be greater for written than oral conversational discourse. The latter is typically embedded in a rich nonlinguistic context which frequently signals the schemata needed to be activated. If not, the hearer

may directly query the speaker (at one extreme, "What are you talking about?"). Written discourse, on the other hand, is relatively decontextualized. Clues to which schemata need to be activated usually must be divined from the text alone; if problems arise, the text can not be queried (for further discussion of decontextualization, see Rubin, in press; Spiro, in press).

The problem of schema activation is further complicated by the level of generality typical of children's knowledge structures. Schemata tend initially to be tied to their contexts of acquisition, rather than achieving a generality permitting application to a broad range of structurally similar situations (Nelson, 1977). For example, the present writer encountered a child having difficulty understanding the well-known "Stone Soup" fable, wherein a beggar is refused food by the servants of a house and then contrives to deceive them into giving him food. The child failed to appreciate the conning element of the story, despite manifesting an understanding of that concept in a subsequent interview. The problem was that the conning schema was insufficiently general; the child understood conning as it applied to his own personal experiences with trying to gain satisfaction deceptively after being thwarted by those with authority. However, that knowledge could not be applied to an appropriate case that was somewhat alien to personal experience.

A related problem concerns the use of schemata by analogy. We can not have a pre-packaged knowledge structure to inform every situation we encounter. However, structural similarities can often be detected

between domains which are well-represented in prior knowledge and domains lacking such representation. In these cases, the existing knowledge structures may be transformed and adapted to fit the new domain. Instances of this phenomenon are common in the history of science, for example. Consider how knowledge about pumps informed the developing understanding of the human circulatory system.

Skill Deficiency

Spiro (Note 1) argues for a two-tiered approach to individual differences in reading comprehension. One tier addresses the component skills of reading comprehension; the other tier is concerned with the manifestation of skill deficiencies in a reading comprehension style. Behavior patterns in the former tier are not considered to have a determinate effect on behavior in the latter tier. At the first tier problems tend to involve skills that are predominantly text-based (e.g., decoding) or knowledge-based (e.g., pragmatic inferencing). Confronted with a skill problem of one of these two types, two options are available to readers: they may persevere in the problem area (with deleterious effects on other processes), or they may escape from the problem by shifting processing resources in an effort to compensate for the problem. Consider readers who are laborious, effortful decoders. They may persevere with their decoding efforts. Given the limitations on information processing capacity, this behavior may produce a "bottleneck" in the system (Perfetti & Lesgold, 1978). The outcome may be that higher-order, more knowledge-based processes will be

neglected. On the other hand, readers who are effortful decoders may

prefer (not necessarily consciously) to avoid the unpleasant decoding

task. One way to do that would be to rely on prior knowledge to infer

or guess what is likely to be in the text rather than actually reading

much of the text. In other words, the same skill deficiency may lead

to either one of two totally different comprehension styles (text-biased

or knowledge-biased) depending on whether the reader perseveres in the

problem area or tries to escape from it. (See Spiro, Note 1, for discussion

of an experiment in which reading comprehension styles were found to be

uncorrelated with decoding accuracy or speed.)

Misconceptions About Reading

Some children seem to think that knowledge-based processing is not an

an appropriate activity in reading. They fail to correctly answer questions

about text that require extra-textual knowledge. When informally interro-

gated, they are perfectly able to answer the same questions. If they are

asked why they did not utilize the same knowledge to answer correctly

after reading, they respond with remarks like "you are not supposed to."

They suffer from what might be called a "meaning is in the text" fallacy

(it is worth noting that, for some children, this fallacy applies only

to their reading for school).

These conjectures about reading misconceptions, which were based on

informal observation and interviews, have received empirical confirmation

in a study by Spiro and Myers (in preparation). Children who responded

to a formal questionnaire about reading concepts with a clear text-based

processing bias also tended to answer simple questions requiring extra-textual knowledge incorrectly, despite possessing the requisite knowledge.

What causes misconceptions of reading as a primarily bottom-up process? Only speculation is possible at this point. However, likely candidates include code over-emphasis in early reading instruction, reading texts that are insular and lacking in relevance to existing knowledge, and tests that stress literal text content rather than its integration with related prior knowledge.

General Cognitive Styles

For some children who under-utilize prior knowledge in understanding text, the problem may transcend reading. Their reading style may be part of a general tendency to process incoming information in similar fashion, regardless of the type of information and its modality of transmission. Text is an external stimulus with a structure. Interactive reading requires that relevant internal knowledge structures be superimposed on the text. Those who are overly "text-bound" in reading situations may tend to be "stimulus-bound" in general.

Consider the requirements of an embedded figures test. A memorized geometric shape (an internal structure) must be located within a complex line and shading configuration in the visual field (an external stimulus structure). Empirical studies have shown that those who have difficulty fitting the memorized internal structure onto the external stimulus structure in an embedded figures test also under-utilize internal knowledge structures in reading comprehension (Spiro, Note 1; Spiro & Tirre, 1979).

"Bugs" in the Comprehension Program

Finally, there may be some individuals whose over-reliance on text-based processes is more apparent than real. That is, because of some idiosyncratic breakdown elsewhere in the system, patterns of reading behavior may elicit a mistaken diagnosis of a given reading style. A case we have identified concerns problems in schema maintenance (Spiro, Brummer, & Boggs, in preparation). Some children appear to be one-sentence-at-a-time readers; they understand individual sentences but fail to integrate information across sentences. One reason is that knowledge structures clearly signaled for activation at one point in the text are not being kept active (or maintained) at later points in the text where they are no longer explicitly evoked (a problem that is not merely one of "forgetting"). Children with this problem fail to engage knowledge-based processes when the requisite knowledge was evoked in previous sentences, but spontaneously perform knowledge-based processes within sentence boundaries. In other words, their top down processing apparatus is intact and is employed; it just frequently does not appear that way because of the schema maintenance problem.

Implications for Educators

Other causes of over-reliance on text-based processes could have been suggested, and a similar list constructed for biases towards knowledge-based processing. However, the present discussion need not be extended for some important common-sense implications to be discerned.

9

It seems obvious that you would not want to employ the same remediation strategy for poor readers with differing comprehension styles. For example, inducing a child to relate what is read to prior knowledge might help a child with a text bias but would reinforce the problem of a child with a knowledge bias. It may not be quite so obvious that you may have to treat children differently who have the same maladaptive reading comprehension style. Yet, if the same reading comprehension style can be attributed to a multiplicity of causes across individuals (keeping in mind that the extent to which causes co-occur for individuals has not yet been determined), instruction may have to be determined by the cause and not by its manifestation. What is likely to help a child with a text bias that results from insufficient background knowledge will probably be different from what will help other children with similar text biases that result from a misconception about what reading is or from a decoding problem. There may be a lesson for reading instruction in the dictum "treat the cause, not the symptom."

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Footnote

[1]For discussion of this orientation, see Anderson, 1977; Bobrow and Norman, 1975; Bransford and McCarrell, 1975; Cofer, 1977; Collins, Brown, and Larkin, in press; Rumelhart, 1977; Rumelhart, in press; Rumelhart and Ortony, 1977; Schank and Abelson, 1977; Spiro, 1977; and Spiro, in press.

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